MODELING ISSUES FOR CONSIDERATION

Models are fraught with uncertainty and can be argued to be conservative or non-conservative using the same information. SEDCAM has been the model run at sites in PH to date and may be useful as a screening tool or a single line of evidence. For the most defensible results of modeling efforts (esp. for stormwater pathway), consistent determinations on appropriate input parameters, sensitivity analysis, and site specific considerations are needed in using and evaluating results.

A. SEDCAM INPUT PARAMETERS AND COMPLICATING FACTORS INCLUDE:

I. Deposition Area Defined – This is a sensitive variable.

1) At individual sites, this varies from ~106,000 sq ft to 416,000 sq ft (2.4 ac to 9.5 ac). We **need to identify a method for estimating outfall deltas** (in consideration of grain size and local scour/deposition regimes?) **or sideboards for BPJ**.

a) Another approach is to request a range (smaller dep area is more conservative).

b) Another is requesting calculation a more realistic fraction that deposits as a second line of evidence (per Reibel email and runs – fraction = residence time of effluent SW/ (area/settling time of particles in SW)).

2) Harbor-wide analysis needs validation of the LWG fate & transport cell approach or some combination of additive analysis of basin, AOPC, restoration area scale RE's…

II. Mass Load

1) Total into defined deposition area – Sedimentation Rate - (Area x Depth x Density)

a) High resolution bathymetry comparisons have error of +/- ~4 in and less precise bathymetry methods have error of +/- ~6 in or more. Estimates at various locations to date range from 0.3 in/yr to 6 in/yr.

b) Particle density can vary per location, but we **need to determine how significant this variable changes model output** and what sideboards should be applied. Measured and assumed densities to date range from 57 lb/cf to 100 lb/cf (0.92 g/cc to 1.60 g/cc).

2) Portion from outfall(s) – (OF(s) avg annual runoff volume x avg OF TSS (measured))

a) Runoff volume calculated using CoP GRID model
b) Runoff volume estimated using SWMM model
c) Runoff volume estimated by compilation of fractions of basin in various land use types

Need to determine if these methods are all comparable and whether differences

Prepared by: Alex Liverman
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change output significantly. Literature indicates that runoff volume estimates, event

mean concentrations, and runoff coefficients are VERY sensitive to land use assumptions. **A consistent method is probably warranted**.

3) Portion from upriver – (Total – OF portion)
   a) Total measured (Depositional area x Bathymetry derived depth x Density)
   b) Total calculated (Depositional area x Anticipated depth x Density)

Upriver portion in those we've seen so far dwarfs outfall contributions, so sensitivity here is unlikely for most sites. However, **we may need additional lines of evidence for consideration at depositional areas, off channel areas (like the Lagoon), and scour areas.**

III. Pollutant Load (to river sediment)

1) Concentration of portion from site stormwater solids
   a) OF avg measured concentrations of specific CoCs x OF avg annual runoff volume
   b) Estimated using SIMPLE model – land use types & % impervious & composited stormwater and sediment trap/TSS data

2) Upriver portion concentration
   a) Use mean concentrations upstream and downstream of site from LWG draft RI
   b) Use upstream data collected by site RP

Is mean the right choice? Should we choose **median, geomean, weighted avg** instead? Comparison runs show the more deposition you have, the lower concentrations end up over time.

3) At discharge point
   a) Existing sediment may be assumed to have pollutant load of zero if new cap
   b) Legacy concentrations may need to be determined at site for MNR sites
   c) Concentrations at discharge may need to account for discharge of other outfalls in close proximity

4) Average Annual Load from outfall (Annual Concentration Load/Annual TSS Load)

   a) TSS has big implications for load because as TSS decreases pollutant load increases significantly (even with low concentrations) and as TSS increases, load decreases.

      i. This is important because BMP/SCM implementation aims to reduce TSS to reduce hydrophobic contaminant releases.

ii. For about 70% of the PH SW data on PCBs with paired TSS, when both are within "typical industrial levels" per DEQ's screening curves, resultant PCB solids loads calculated [PCB]/[TSS](as in SEDCAM prior to mixing getting figured in) are well above typical industrial levels.

iii. Mixing of the upriver load with the outfall load appears to negate most concerns for high loads from outfalls in the Willamette. There are exceptions, notably BEHP.

These issues may **need examination/validation by literature and experts**.

IV. Depth of Mixing (bioturbation & physical processes) – assumed to be uniform

1) EPA's recommendation is 25 cm (~10 in)
2) Most RE's to date have used 0.5 ft (~15 cm)
3) No lateral mixing is assessed, though this can be much more significant than vertical mixing due to bioturbation, such that most action takes place in the top 1 cm to 4 cm (Moharty, Reible & Thibodeaux, 1998). Lateral mixing is probably accounted for in conservative model assumptions of total deposition and zero degradation.

Comparison runs at 10 cm and 25 cm show no little difference in output, such that **this parameter appears insignificant for most in-river sites.** Using 10 cm or less (or a range) is more conservative, since deeper mixing allows for lower resultant concentrations, and **10 cm may be appropriate in more quiescent areas without prop wash, etc.**

V. Duration for cumulative evaluation.

1) 10 to 20 to 30 years – in 1 year increments? – the further predicted out, the more error compounded in estimated inputs.
2) Is this different for vacant sites vs. on-going operations?
3) When do river processes come into this equation? For PH (big river), assuming no transport should be conservative, assuming incoming sediment is cleaner. For the lagoon and other offchannel/backwater/depostional areas this may be reversed (i.e. Columbia Slough with in-river sediment dirtier than treated stormwater solids).
4) Does any of this matter? Preliminary trials of Basin 19 OF indicate that, for some CoCs, constant SW concentrations into constant river sediment concentrations eventually asymptote out. Need to run more scenarios of more basins and more CoCs…

VI. Comparison values

1) EPA In-river ROD clean-up levels
2) JSCS bioaccumulation SLVs
3) Site specific in-water clean-up levels (Zidell)
4)Others?
5)All?

B. Conservative assumptions of SEDCAM for consideration in interpreting results:

I. All of the contaminant load is associated with solids – even more conservative when total concentrations are used rather than partitioned fractions (dissolved, colloidal, solids).
II. No chemical degradation occurs in situ.
III. Total deposition of all stormwater solids into defined deposition area. Does not account for concentration reductions due to transport by river (scouring from area of deposition of clean material into area).

C. Non-conservative assumptions of SEDCAM model:
   I. Uniform mixing over entire depositional area. This makes it more important to define the depositional area conservatively. Does not account for sub-areas that may have higher concentrations, in the event that concentrations are close to SLVs.
   II. Because of assumption of total deposition at outfall, does not look at downstream concentrations due to transport, or settling of finer particles and eventually colloids. While these fractions can be assumed to be less than acceptable levels determined by the model, downstream depositional areas (like the Swan Island Lagoon) could accumulate unacceptable concentrations over time (other lines of evidence or regional/harbor-wide analyses may address this).
   III. Looks only at stormwater solids contributions to sediment, so doesn't address water column and fish tissue concentrations (though LWG fate & transport modeling work can be paired w/RE to get at this?)